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Method for use in a conveyor and a conveyor

The present invention relates to a method according to the preamble of claim 1 for separating web rolls on a conveyor from each other.

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The invention also relates to a roll conveyor suited for implementing the method.

Web rolls manufactured on a paper or paperboard machine are slit at a slitter-winder from a wide machine roll into rolls of narrower width according to customer order.

10 Slitter-winders fall into two main types: shaft-supported slitter-winders, in which the slit rolls are delivered from the slitter in two different sets to both sides of the winder, and surface-driven slitter-winders, in which the slit rolls are delivered as a complete set. Since surface-driven belt-supported slitter-winders are based on the same principle as surface-driven roller-supported slitter-winders, in a general sense it is  
15 appropriate in this context to assign the term "surface driven slitter-winder" to any winder-slitter capable of delivering the rolls as a complete set.

Rolls manufactured on a surface-driven slitter-winder must be separated from each other for such reasons as, e.g., quality checks, before the slit rolls can be transferred  
20 further to a labeling and packaging station. Conventionally, the rolls of a roll set delivered by the slitter-winder are separated from each other at a transition point between two roll conveyor sections. When the separation point between the first and second roll of a roll set coincides with the transition point between the conveyor sections, the first conveyor is stopped, whereby the first roll of the set continues its  
25 travel on the second conveyor, while the other rolls of the set remain on the first conveyor. Subsequently, the separation point between the second and third roll is driven to the transition point between the conveyor sections, whereupon the first conveyor is stopped causing the second roll to continue its travel on the second conveyor, while the other rolls of the set remain on the first conveyor. The same  
30 sequence is repeated until all of the rolls of the set are separated from each other.

The rolls of a set received from a slitter-winder may stay adhered to each other due

to different reasons: the core ends are not flush with the web roll ends, the sheet edges of the rolls are slit uneven leaving them interleaved with each other or slitting has been started too late whereby the core still has some layers unslit. If the rolls adhere to each other, problems may occur at the transition point between the conveyors in the case that the rolls fail to separate. To avoid such complications, full separation of rolls must be checked in a set received from a surface-driven slitter-winder. While checking the separation of rolls in a set may occur at any place along the transfer of the roll set, generally the check is performed through arching the roll set by way of elevating the middle rolls of the roll set upward so much that the roll ends separate from each other leaving a gap therebetween. At this moment, the operator checks visually that all rolls are separated from each other and, if necessary, uses a wedge to force apart any rolls adhering to each other. Although modern slitter-winders are extensively automated, yet monitoring the rolls in a roll set and separation of the rolls from each other are operation still being performed manually. These worksteps prevent running a slitter-winder with lesser manpower. In addition to being monotonous and tedious, such operator tasks may be even hazardous if carried out counter to instructions or by negligence. Sufficient time must also be reserved for the operator's actions to permit his checks on the roll set to be performed safely. Due to the manual separation of rolls, the operation of the slitter-winder and the roll conveyor system is slowed down.

It is an object of the present invention to provide a novel method for separating rolls of a roll set received from a slitter-winder apart from each other without the need for mechanical intervention by the operator. It is a further object of the invention to provide a conveyor capable of implementing the method.

The goal of the invention is attained by virtue of separating the rolls of a roll set resting on a conveyor with the help of an elevating roll assembly that is situated under the conveyor chain or belt and comprises at least one freely rotating elevating roll. The elevating roll assembly forms on the top surface of the conveyor chain or belt an elevation directed upward. As the rolls travel over the elevation, the end-to-end abutting web rolls of the roll set are deflected in regard to each other, whereby

any adhering rolls are separated from each other. The separating effect is augmented by the forces generated by the small speed difference between the web roll lifted onto the elevation and those traveling on the base level of the conveyor belt or chain. Additionally, the shape of the conveyor chain slats and/or elevating rolls puts the conveyor chain or belt into a reciprocating up and down motion that detaches the adhering web rolls from each other.

More specifically, the method according to the invention is characterized by what is stated in the characterizing part of claim 1.

Furthermore, the roll conveyor according to the invention is characterized by what is stated in the characterizing part of claim 4.

The invention provides significant benefits.

Now automated separation of web rolls in a set becomes possible thus reducing the number of mechanical and tedious operations the personnel have to perform in a close vicinity of the rolls. Additionally, the operation of the slitter-winder as well as the roll conveyor system is accelerated, since the system need not be stopped for separating the rolls of a set. The embodiment according to the invention also has a simple construction that can be readily installed on existing roll conveyor layouts.

In the following, the invention is examined in more detail with the help of the appended drawings.

Figure 1 is a top view of a set of web rolls received onto a roll conveyor from a slitter-winder.

Figure 2 is a sectional view of FIG. 1 taken along plane A-A.

Figure 3 is a partially enlarged view of FIG. 2 taken at point C having an elevating conveyor roll assembly adapted below the top level of the conveyor chain.

Figure 4 is a sectional view of FIG. 3 taken along plane B-B.

Figure 5 is a schematic side elevation view of the top level of a conveyor chain or  
5 belt at the elevating roll assembly.

Referring to FIG. 1, therein is shown the travel of paper or paperboard web rolls 2 of a roll set 1 received from a slitter-winder 11 of paper or paperboard machine as the rolls gravitationally move along a downward ramp 9 until the rolls are stopped onto a  
10 conveyor 3 by a stop gage. The rolls of the roll set 1 rest on the conveyor 3 with their ends abutting each other and the center axes aligned in the transport direction of conveyor 3. The transport direction of conveyor 3 is designated by arrow 10 in FIGS. 1 and 2. The rolls 2 have the underside of their circumferential periphery resting against the top surface of the conveyor chain or belt 12 of conveyor 3. After  
15 the rolls of roll set 1 are stopped onto conveyor 3, they are separated from each other at the transition point between the conveyor 3 and an other conveyor 4. The separation of rolls 2 from each other takes place by way of moving the set 1 of web rolls on conveyor 3 toward the second conveyor 4 until the abutment plane between the first and second roll of set 1 coincides with the transition point of the conveyor 3 and the  
20 other conveyor 4. At this instant, the conveyor 3 is stopped whereby the first roll of set 1 continues its travel on the other conveyor 4. Subsequently, the roll set is moved on the conveyor 3 so that the abutment plane between the second and third roll of the set coincides with the transition point of the first conveyor 3 and the other conveyor 4, whereupon the conveyor 3 is stopped and the second roll of the set continues its  
25 travel on the other conveyor 4. The sequence is continued until all the rolls 2 of set 1 are separated from each other.

Typically, conveyor 3 is a slat conveyor. Adapted moving about driving and tail pulleys 7 is an endless conveyor link chain loop 12 comprising two parallel-running  
30 lateral chains connected to each other by slats 8. In the endless conveyor chain 12, the long sides of the transverse slats 8 are shaped so that recesses 13 remain between the adjacent slats 8. The driving and tail pulleys 7 have teeth adapted to fit between

the links of the lateral chains thus facilitating transmission of the driving pulley rotation into a linear motion of conveyor chain 12. As shown in FIG. 4, the slats 8 are slightly shaped in a V-angle thus making the slats 8 when running on the top leg of the conveyor chain to slant downward from the ends of the slat toward the center of the slat.

To separate adhering web rolls 2 of a roll set 1 from each other, conveyor 3 is provided with an elevating roll assembly 5 comprising at least one freely rotating elevating roll 6. Typically, the elevating roll assembly 5 includes two to four elevating rolls 6 adapted to operate in succession along the travel direction 10 of conveyor 3. In a preferred embodiment of the invention illustrated in the drawings, the number of the successive elevating rolls 6 is two.

The elevating roll assembly 5 is adapted between the top leg and bottom leg of the endless loop chain of conveyor 3 so that the top leg of the conveyor chain is elevated at the elevating rolls 6 by a few millimeters, typically 2 to 6 mm, from the base level 14 of the conveyor chain top leg. The outer surfaces of the elevating rolls 6 are covered by an elastic lining such as polyurethane. Each one of the elevating rolls 6 is comprised of two wheels 15 aligned parallel to each other in the travel direction of conveyor 3, the wheels having disposed therebetween a spacer member 16 with a diameter smaller than that of the wheels 15. The spacer member 16 is mounted on the conveyor frame and the wheels are respectively mounted in bearings on the spacer member 16. The elevating roll 6 is placed under the top leg of the endless loop conveyor 3 so that the center point of the top leg of the conveyor chain relative to the lateral dimension of the conveyor chain 12, that is, the center valley point of the V-angled slats 8, coincides with the spacer member 16 and the wheels 15 run symmetrically on both sides of the conveyor chain center line. The peripheral diameters of wheels 15 are tapered toward the conveyor chain center line thus making them more compliant to the V-angled shape of slats 8. The center points of slats 8 do not touch the spacer member 16. To support the top surface of conveyor chain 12, the lateral chains are provided with support wheels 18 that run along rails 17 mounted on the frame of conveyor 3. The support wheels are arranged to operate in two adjacent

rows in regard to the travel direction 10 of conveyor 3. Wheels 15 of elevating roll 6 and the spacer member 16 mounted therebetween are adapted between the support wheel rows.

- 5 If the number of the elevating rolls 6 is two or more, the mutual distance  $d_1$  between the shafts of the successive elevating rolls 6 is about 125 mm. When using, e.g., two elevating rolls 6, this makes the length  $d_2$  of the elevation formed by the elevating rolls 6 on the top leg of the conveyor leg to be about 200 mm. The length of the elevation is determined by the number and diameter of the elevating rolls 6, as well  
10 as the mutual spacing between the successive elevating rolls. In a conveyor equipped with two elevating rolls 6, the length  $d_2$  of the elevation is typically 150 to 200 mm.

The separating motion imposed on the paper web rolls 2 resting on the top leg of the chain of conveyor 3 supported by the elevating roll assembly 5 is illustrated in more  
15 detail in FIG. 5. The abutting ends of successive paper web rolls 2 are angled four times in regard to each other as they pass over the elevation formed by the elevating roll assembly 5 on the top leg of the conveyor chain. Each deflection promotes the separation of the paper web rolls 2 from each other. The first deflection occurs when the paper web roll meets the upward-slanting portion 19 of the top leg of conveyor  
20 chain 12, while the next following web roll still rests on the base level 14 of the conveyor chain top leg. The second deflection occurs when the paper web roll falls onto conveyor chain portion 20 running on the elevating rolls 6 of the conveyor chain top leg. The web rolls are angled mutually the third time when the web roll falls onto the downward-slanting portion 21 of the conveyor chain. The fourth  
25 deflection occurs when the web roll lands onto the conveyor chain base level 14 following the elevating rolls.

In addition to the bending force imposed on the web rolls of a set, the rolls are subjected to a reciprocating up and down movement as the elevating rolls  
30 alternately sink into the elongated recesses 13 between the adjacent slats 8 and then again hit the projections of the lower surfaces of the slats 8. The travel speed of the chain top leg of conveyor 3 is slightly different on the base level 14 ( $v_1$ ) of the chain

top leg as compared to the conveyor speed ( $v_2$ ) on the chain portion 20 running on the elevating rolls 6. Due to the instantaneously faster transport speed of the paper web roll on the chain portion 20 passing over the elevating rolls 6 as compared to the roll transport speed on the conveyor's flat portion, that is, the base level 14 of the conveyor, also this speed difference imparts a separating effect on the adhering web rolls.

The invention may have embodiments different from those described above.

10 The separating effect can be enhanced by providing the conveyor chain top level with several elevations by adapting plural elevating roll assemblies along the travel length of conveyor 3.

15 The invention may also be utilized in other types of conveyors. If the conveyor is a belt conveyor or flat slat conveyor having the slats shaped shallower than those of the above-discussed roll conveyor, whereby a sufficiently wide elongated recess is not provided between adjacent slats, the reciprocating up and down motion can be accomplished by means of a suitably designed shape of the elevating rolls 6. To this end, the periphery of the elevating rolls 6 may have, e.g., a polygonal or elliptic  
20 shape or, alternatively, the elevating rolls 6 may be adapted to rotate eccentrically.

The spacer members 16 between the elevating rolls 6 may be complemented with actuators allowing the elevation height formed by the elevating rolls 6 to be adjustable during the operation of conveyor 3.